REMARKS

The above Amendments and these Remarks are in reply to the Office Action mailed August 20, 2004. Currently, claims 1-10 and 12-20 are pending.

I. Summary of the Rejections

Claims 1, 4-10, 12 and 20 were rejected under 35 U.S.C. 102(b) or 102(e) as being anticipated by either U.S. Patent 5,631,422 ("*Sulzberger, et al.*") or U.S. Patent 6,122,964 ("*Mohaupt et al.*") or U.S. Patent 6,151,966 ("*Sakai et al.*").

Claims 2-3 and 13-19 were rejected under 35 U.S.C. 103(a) as being unpatentble over either *Sulzberger, et al.* or *Mohaupt et al.* or *Sakai et al.* in view of U.S. Patent 6,230,563 ("*Clark, et al.*").

II. Summary of the Amendments

Claim 1 has been amended. It is respectfully submitted that the objection to claims 1 – 3 is now moot.

III. Remarks

It is respectfully submitted that the invention as defined in the present claims is not anticipated by *Sluzberger et al.*, *Mohaupt et al.* or *Sakai et al.*

It is respectfully submitted that the Examiner has failed to set forth a prima facie rejection under 35 U.S.C. §102. Specifically, the Examiner has failed to set forth a single reference showing each limitation of the claimed invention -- there is no teaching of a microsturcture wherein an "...electrical circuit..." provides "...a position-dependent electrostatic force having a magnitude varying in proportion to relative displacement of said at least one second finger to the two first fingers along said first displacement axis."

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987) (MPEP §2131). Hence, all of the structural elements called for in the present claims must be shown to be anticipated.

The references cited do not disclose the claimed electrical circuit. The portions of the reference cited as supporting a disclosure of this limitation do not disclose the claimed electrical circuit, much less the combination of such circuit with the claimed structure.

Claim 1 calls for:

> an electrical circuit providing a position-dependent electrostatic force having a magnitude varying in proportion to relative displacement of said at least one second finger to the two first fingers along said first displacement axis.

Independent claims 4, 13 and 20 all include limitations directed to electrical circuits having similar scope. None of the cited references teach this limitation of applicant's invention, either explicitly or implicitly.

This feature of the invention is discussed in the specification as follows:

> A quadrature-nulling force, with Y-axis value having a component proportional to X-axis displacement, is generated by applying a voltage V between the two electrical nodes formed by like interconnected fingers [p. 15, ll. 12 – 15] . .... When Y_1 is not equal to Y_2, F_y is a function of relative X-axis displacement, and correspondingly appears as an off-axis diagonal element when represented in spring matrix form. Since this spring-force may be adjusted by voltage *V*, it may be used to cancel off-axis spring terms due to, for instance, imperfections in the suspension. An important advantage of the present invention may now be noted. ***When the comb-finger capacitors comprise a conductive material, and the voltage across the comb-finger capacitor is provided by a low-impedance voltage source, such as the output of an operational amplifier connected in negative feedback, or a electrochemical battery, there is essentially zero phase error between proof-mass position along the drive-axis and the force F_y.*** An in-phase relationship between these two quantities enables effective cancellation of off-diagonal terms in the spring-matrix, thereby providing improved oscillation. [p.17, lines 2 - 14]

It is respectfully submitted that the references cited by the Examiner utterly fail to disclose the claimed electrical circuit appearing in each of the independent claims.

For example, *Sluzberger et al.* teaches no mechanism for providing the claimed voltage, nor even the type of sensing circuitry used to determine the capacitance between the movable electrodes disclosed therein. As the Examiner's rejection is presently understood, the electrical circuit in *Sulzberger et al.* is disclosed at "column 1, line 45 to column 2, line 21. That portion of the

Sulzberger et al. reference is set forth below:

> FIG. 1 shows a plan view of a sensor 1 according to the present invention. The sensor has a movable element which is formed by the spring elements 5, the central bar 2 and the movable electrodes 21, 22. The movable element is displaced from its starting position by an acceleration along the longitudinal axis of the central bar 2. Sensors having movable elements of this type are described in German Patent Application No. 44 19 844 and are used as acceleration sensors. The spring elements 5 are fastened to bearing blocks 3. The sensor further has stationary electrodes 31, 32, which are suspended from bearing bars 4.
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> FIG. 3 shows a cross section through the sensor according to FIG. 1 along the line III--III. As is evident in FIG. 3, the sensor is formed from a multilayer board. The lower layer of the multilayer board comprises a substrate layer 8. A first silicon layer 6 is provided on the substrate layer 8. The individual elements of the sensor are essentially structured from this layer 6.
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> The spring elements 5, the central bar 2 and the movable electrodes 21, 22 are structured from the first silicon layer 6 and have a spacing from the substrate layer 8. These elements are therefore movable relative to the substrate layer 8. The spring elements 5 are fastened to the bearing blocks 3. These bearing blocks 3 are connected to the substrate layer 8 by a dielectric layer 7. Consequently, the bearing blocks 3 are permanently anchored on the substrate layer 8. Furthermore, the bearing bars 4 are connected to the substrate layer 8 by the dielectric layer 7. Consequently, the bearing bars 4 are also permanently anchored on the substrate layer 8.
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> The stationary electrodes 31, 32 are suspended from the bearing bars 4. The geometric dimensions of the stationary electrodes 31, 32 are selected in such a way that they are displaced only to an insignificant extent in the event of accelerations. In contrast, the spring elements 5 are constructed such that an acceleration along the longitudinal axis of the central bar 2 effects a deformation of the spring elements 5. This leads to a change in the distance of the movable electrodes 21, 22 from the stationary electrodes 31, 32. This Change in the distance between the electrodes can be detected by measuring the capacitance between the movable electrodes 21, 22 and the stationary electrodes 31, 32. Therefore, the sensor according to FIG. 1 can be used as a capacitive acceleration sensor.

There is no reference to an "electrical circuit" as claimed in this cited portion of the reference; indeed, this section does not even disclosure applying a voltage of any sort to accomplish sensing. Hence, any rejection under 35 USC Section 102(b) is not supported by this reference.

Likewise, there is no disclosure of a circuit as defined in the claims in *Mohaupt et al.* As understood, the Examiner cites column 2 line 56 to column 3, line 39 as disclosing an "electrical circuit" as claimed. That portion of the specification, reproduced below, also discloses no electrical circuit, much less one which provides the claimed "position dependent electrostatic force":

> According to the present invention, the excursion can be reset to zero in the closed-loop method even at higher frequencies, making it possible to achieve better dynamics.

> Staggering or distributing the natural frequencies of the prongs or prongs reduces the amplitude of the prong mode (interference mode), due to the variety of the different staggered natural frequencies. In other words, the maximums are spread according to the interference mode shown in FIGS. 3a and 3b so that they no longer have any significance for the evaluation method. This provides more amplitude reserves for a closed-loop evaluation, making it possible to close the loop with the desired higher loop gain.
>
> The same holds true for the above-described evaluation errors that occur with higher-frequency signals. The errors are reduced through the number of staggered arrangements selected.
>
> According to one embodiment of the present invention, the prongs of at least one of the comb devices have a variable geometry, in particular, a variable length and/or width and/or height. This is a suitable method, from a process engineering standpoint, for expanding the mechanical natural frequency spectrum.
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> According to another embodiment of the present invention, the prongs of at least one of the comb devices have a variable material structure. This can be achieved, for example, by varying the mass through depositing additional material on the prongs.
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> According to another embodiment of the present invention, pairs of two adjacent prongs, one of which belongs to the first comb device and the other to the second comb device, have the same geometry.
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> According to another embodiment of the present invention, the length of the prongs increases gradually from a first value at one end of the comb device to a second value in the middle of the comb device and, from here, decreases gradually again to the first value in the direction of the other end.
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> According to another embodiment of the present invention, at least one portion of the prongs has a double-arm structure with a first prong, a second prong, and at least one connecting web between the two prongs. This is a further suitable method, from a process engineering standpoint, for tuning the mechanical natural frequencies, for example by varying the number and position of the connecting webs.

At best, *Mohaupt et al.* discusses use of the structure disclosed therein with well known closed loop measurement techniques (as in Figs. 3a and 3b). The specific use of voltages relative to such measurements is not disclosed, nor is any electrical circuit for doing so.

Finally, there is no disclosure of an "electrical circuit" as claimed in the *Sakai et al.* reference, including the portion cited by the Examiner:

> Referring first to FIG. 1, a semiconductor accelerometer device 11 is formed on an SOI substrate by using the semiconductor fabrication process.
>
> A movable unit 12 has anchors 13, rectangle-shaped springs 14 integral with the respective anchors 13, a weight portion 15 integral with and provided between the springs 14, and a comb-shaped movable electrode 16 integral from the weight portion 15. The movable electrode 16 has a plurality of parallel fingers extending laterally from the weight portion 15 in opposite directions. A pair of comb-shaped fixed electrodes 17 and 18 is provided at both lateral sides of the weight portion 15. Each of the fixed electrodes 17 and 18 has a plurality of fingers extending laterally between the fingers of the movable electrode 16.
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> As shown in FIG. 2, the accelerometer device 11 is fabricated from the SOI substrate, which comprises a first semiconductor layer (Si) 19, a second semiconductor layer (Si) 20 and an insulator layer (SiO_2) 21 as a support layer. The first semiconductor layer 19 and the insulator layer 21 are removed to expose the second semiconductor layer 20 over

> the area where the movable unit 12 and the fixed electrodes 17 and 18 are formed.
>
> In fabricating the accelerometer device 11, aluminum (Al) is vapor-deposited on the top surface of the SOI substrate at pad portions 25 to 27 to form the electrode pad portions 28 to 30. After polishing the bottom surface of the SOI substrate, plasma SiN is accumulated. Then, the plasma SiN film is etched to form a predetermined pattern.
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> Then, PIQ (polyimide) is pasted on the top surface of the SOI substrate, and the PIQ film is etched in a predetermined pattern which corresponds to the movable unit 12 and the fixed electrodes 17 and 18. A resist is pasted as a protective layer on the PIQ film. The SOI substrate is etched deeply by, for instance, KOH aqueous solution, while using the bottom side plasma SiN film as a mask. In this deep etching, the insulator layer 21 functions as an etching stopper, because the etching speed of the insulator layer 21 is slower than that of the Si semiconductor layer.
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> Next, after removing the exposed insulator layer 21 and plasma SiN film by the HF aqueous solution, the resist covering the top surface of the SOI substrate is removed. The second semiconductor layer 20 is dry-etched to form holes therethrough, while using the PIQ film as a mask. Thus, the movable unit 12 and the fixed electrodes 17 and 18 are formed in the second semiconductor layer 20. Finally, the PIQ film on the top surface is removed by the O_2 ashing.
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> In the accelerometer device 11 as fabricated above, the both axial ends of the movable unit 12 are supported on the insulator layer 21, and the fixed electrodes 17 and 18 are cantilevered on the insulator layer 21.

The aforementioned reference section teaches nothing wither respect to an electrical circuit. The only discussion of any length of a circuit is in the Sakai et al reference, and this is in regard to the switched capacitor circuit of Figure 25 which represents a schematic representation of an accelerometer with parasitic capacitor and variable capacitors.

Hence, the Examiner's rejection of Claims, 1, 4, and 20, and the claims dependent therefrom, is unsupported by the disclosure of the references. There is no explicit disclosure of circuitry to provide the claimed position-dependent electrostatic force along the displacement axis.

Likewise, the invention as defined in claims 5 – 7, requiring an "oscillation-sustaining feedback loop", "a capacitive bridge" and "position sense interface" and a voltage which is "substantially constant", are not disclosed. The Examiner has rejected these claims as anticipated based on the same grounds as those set forth with respect to claims 1 and 4. There is no disclosure of the above limitations in the aforementioned claims.

Moreover, claims 12 -15, defining the specific elements comprising the circuitry used in combination with the structure, are not disclosed in the cited prior art. These claims define limitations to circuit components wholly lacking in any of the disclosures of the cited prior art

references.

It is further respectfully submitted that claims 2 – 3 and 13 – 19 are likewise not obvious over *Sluzberger et al.*, *Mohaupt et al.* or *Sakai et al.* Claims 2 – 3 depend from claim 1 and as noted above, the prior art fails to teach more than merely the "dimensions and parameters for the first fingers and the second fingers…" as cited by the Examiner. *Sluzberger et al.*, *Mohaupt et al.* or *Sakai et al.* would not teach one of average skill in the art the claimed "electrical circuit" as noted above. Moreover, the Examiner asserts that claims 13 – 19 "… are commensurate in scope with claims 4 – 10 and 20 and are rejected for the same reasons as set forth…" with respect to claims 4 – 10 and 20. For the reasons set forth above with respect to claim 4, and claims 12 – 15, it is respectfully submitted that claims 2 – 3 and 13 – 19 are not obvious over *Sluzberger et al.*, *Mohaupt et al.* or *Sakai et al.*

Hence, it is respectfully submitted that the invention as defined herein is not anticipated by, nor obvious in view of the cited prior art.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 501826 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

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